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ANNUAL REPORT

1962

BURLINGTON - ELIZABETH GARDENS

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Annual report 1962 on
Burlington Elizabeth Gardens :
water pollution control plant.
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ANNUAL REPORT

1962

ON

BURLINGTON ELIZABETH GARDENS

WATER POLLUTION CONTROL PLANT

OWRC PROJECT - 58-S-28

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BURLINGTON ELIZABETH GARDENS

WATER POLLUTION CONTROL PLANT

OWRC PROJECT NO. - 58-S-28

OPERATED FOR

THE TOWN OF BURLINGTON

BY

THE ONTARIO WATER RESOURCES COMMISSION

Mr. A. M. Snider	Chairman
Dr. A. E. Berry	General Manager
Mr. D. S. Caverly	Assistant General Manager and Director of Plant Operations
Mr. B. C. Palmer	Assistant Director, Division of Plant Operations
Mr. D. A. McTavish	Project Engineer, Division of Plant Operations

Prepared by the
Division of Plant Operations

BURLINGTON - ELIZABETH GARDENS

GENERAL

The Burlington Elizabeth Gardens Sewage Treatment Plant is one of two activated sludge type sewage treatment plants operated for the Town of Burlington by the OWRC.

The plant is located in close proximity to residential properties in the Elizabeth Gardens subdivision near the eastern boundaries of the Town of Burlington.

Design was by Proctor & Redfern, with Schwenger Construction Company Limited the prime contractor.

The project was placed in full operation in June 1960.

PLANT DESCRIPTION

The plant provides complete treatment using the activated sludge process along with pretreatment and sludge digestion.

Sizing

Design Population	7,500 persons
Design Plant Flow	750,000 GPD
Raw Sewage BOD	253 ppm

Total BOD 253 x 750,000 x 10 = 1,900 lb/day

PRIMARY TREATMENT

Screening

Barminutor - Chicago Pump Company

Model B - Size 18

Grit Removal

Air degrittor - 8' x 14' x 7'

Retention Period - 10 minutes

Primary Settling

2 Dorr Clarifiers

Size 22' ∅ x 9' SWD

Retention at Design - 1.4 hours

Surface settling rate = 980 gal/sq. ft./day

Raw Sludge Pump - Carter 10" piston unit

SECONDARY TREATMENT

Aeration Section

2 tanks - 19'-6" x 98' x 12' SWD

Volume - 286,000 Imperial Gallons

Retention (no return considered) - 9.1 hours

Diffusers - 120 Colaflex units

Compressors - 2 - 750 cfm units

Air Per Gallon Possible 2.9 cf/gal.

Return Sludge Pumps (2)

Smart-Turner #A WIV unit equipped with a varispeed drive and 3 HP motor. (1170- 585 RPM)

Capacity 364 IGPM @ 13'

Final Settling

One unit 40' x 40' x 9' A.D.

Volume - 90,000 Imperial Gallons

Retention at Design - 2.9 hours
Surface settling rate - 470 gallons/sq.ft./day
Weir overflow rate - 5,000 gallons/ft./day

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SLUDGE DISPOSAL

Digestion

One heated digester 25' ∅ x 20' SWD

Volume - 35,000 cu. ft.

Per capita loading - 4.7 cu. ft./capita

Heater - Walker gas oil unit rated at 250,000 BTU per hour

Roof - Dorr fixed steel dome equipped with 10 HP draft tube mixer.

Recirculation Pump (2)

Chicago Pump vertical VPMLMC 4 rated at 150 IGM at 25 feet head, powered by 2 HP motor, 1150 rpm.

Final Disposal

By tank truck to farms.

CHLORINATION

Effluent chlorination contact time is obtained 10 minutes in contact chambers and 14 minutes in 600 ft. long, 18' ∅ corrugated steel outfall sewer.

PLANT PERFORMANCE

(1) Plant Loadings and Removals

The hydraulic loading on the plant is shown on Table I, Graph I and Graph II. As indicated in Table I, the maximum daily flow recorded was 1,402 MGD. The design hydraulic loading is .75 MGD and, therefore, the maximum daily flow

represents 187% of the design flow. Graph I shows that the design hydraulic capacity of the plant was exceeded 10% of the time. These extreme flows result from storm water and can cause operating difficulties.

The chief operator of the plant has indicated approximately 32 days (9% of the time) during the year in which heavy flows resulted in the loss of solids from his aeration section and the result was a poor quality effluent during this period. It should be noted that the total flows reaching the plant are not always recorded by the flow meter. If the flow is great enough, the plant is bypassed. Therefore, the maximum flow of 1.402 MGD was not the maximum flow reaching the plant, but was only the maximum flow receiving primary treatment. It is estimated that the maximum flows reaching the plant exceeded 2.0 MGD.

During periods of heavy flows, the operator partially bypasses the aeration section in an attempt to conserve the solids in this section. During these periods, a poor quality effluent results.

The average daily flow for the year was 0.430 MG. The maximum monthly flow approached the hydraulic "monthly" capacity of the plant and was 18.4 MG.

The BOD loading on the plant was quite extreme during portions of the year. This extreme loading resulted in poor quality effluents. Graph II indicates the concentration of BOD in the raw sewage and final effluent. During periods of high concentrations of BOD in the raw sewage, a corresponding high concentration in the final effluent was noted. This was

particularly evident during January, February, March, April, May, November and December. It was reported that a local meat packing plant was not operating during the months not included in the above. Graph III shows the total pounds of BOD reaching the plant per month. It is evident that there were four months during which the plant was overloaded on the average for the entire month. Loadings on individual days were even more in excess of the plant design capacity.

In summary, the plant received flows in excess of its hydraulic capacity approximately 10% of the time. These flows caused operating problems and poor quality effluent. The plant also received heavy organic loading approximately one-half the time. The heavy organic loadings resulted in high air requirements, increased sludge haulage and poor quality effluent.

As indicated in Table II, the plant efficiency remained high during the year even under the adverse conditions indicated above.

(2) Aeration Section

Operating results on the aeration section are show in Table III. The concentration of BOD in the feed to the aeration section ranged from 493 ppm to 76 ppm with an average of 171 ppm. These figures are the average concentration per month and are based on four samples each. Loadings on individual days would be higher or lower than those indicated above.

In addition to the varying concentration in the feed, the aeration section was subjected to hydraulic shock loads. These shock loads often resulted in a loss of mixed liquor suspended solids from the aeration section.

Graph IV shows the loadings the aeration section was subjected to during the year. The first portion of this graph shows the relationship between the feed to micro-organism ratio (pounds of BOD per 100 pounds of mixed liquor suspended solids) and the sludge volume index. A high sludge volume index (above 200) can be indicative of operating problems in the aeration section. The graph indicates generally that high SVI's were encountered with high loadings. However, the data relating to loading is based on one sample per week and it is difficult to observe an accurate relationship between the two variables.

The second chart on Graph IV shows the concentration of MLSS in the aeration section and the aeration tank feed during the year. The feed (pounds of BOD) is determined by a laboratory test which requires five days for analysis. It is therefore difficult to balance the concentration of the MLSS with the feed. This is especially true when the feed varies over a large range. The feed, as indicated on the chart, was consistent during the summer months and, as a result, an effluent with a low BOD concentration was produced.

The final chart on Graph IV shows the air consumption during the year. This consumption was quite high during the spring and fall as a result of the strong feed to the aeration section. The supply of air is one of the chief contributors to the cost of power.

(3) Digestion

Sludge was removed from the plant by tank truck during the year. The volume to be hauled varied from month to month

depending largely upon the strength of sewage reaching the plant. The maximum amount hauled per month was 115,475 gallons in January and the minimum was 13,647 gallons during July. The total hauled during the year was 730,189 gallons (an average of 61,000 gallons per month).

FLOW RECORDS M.G.D. AND GRIT REMOVAL

MONTH	MAXIMUM 24 HOUR FLOW	AVERAGE 24 HOUR FLOW	MINIMUM 24 HOUR FLOW	TOTAL MONTHLY FLOW MG	GRIT REMOVAL	
					CUBIC FEET	CU.FT./MG
JANUARY	0.624	0.371	0.193	11.512	49	4.2
FEBRUARY	0.884	0.326	0.142	9.123	44	4.8
MARCH	1.080	0.600	0.335	18.400	49	2.6
APRIL	0.640	0.436	0.203	13.050	24	1.8
MAY	0.588	0.342	0.253	10.600	64	6.0
JUNE	0.755	0.316	0.211	9.500	37	3.8
JULY	0.530	0.247	0.105	7.657	55	7.2
AUGUST	0.535	0.277	0.132	8.573	68	7.9
SEPTEMBER	1.330	0.368	0.201	11.053	68	6.1
OCTOBER	1.402	0.638	0.287	19.788	76	3.9
NOVEMBER	1.151	0.709	0.427	21.268	84	3.9
DECEMBER	1.148	0.527	0.196	16.344	42	2.6
TOTAL				156.868	660	
AVERAGE		0.430		13.050	55	4.6

NOTE:

All flow rates expressed in millions of gallons per day.
Average daily flow for the year was 0.430 MGD.

TABLE II

BOD AND SS REMOVAL

MONTH	BOD				S.S.			
	INFLUENT PPM	EFFLUENT PPM	PERCENT REDUCTION	TONS REMOVED	INFLUENT PPM	EFFLUENT PPM	PERCENT REDUCTION	TONS REMOVED
JANUARY	706	35	95.0	38.6	504	49	90.2	26.6
FEBRUARY	902	50	94.4	38.8	660	50	92.4	27.8
MARCH	681	28	95.8	60.0	538	35	93.4	46.4
APRIL	490	19	96.1	30.8	282	28	90.0	16.6
MAY	396	10	97.4	20.5	340	31	90.8	16.4
JUNE	152	11	92.7	6.7	177	10	94.3	7.9
JULY	132	19	85.6	4.3	143	19	87.0	4.8
AUGUST	121	15	87.1	4.5	155	31	79.9	5.3
SEPTEMBER	190	16	93.4	8.8	199	39	92.2	10.1
OCTOBER	124	16	87.0	10.6	116	8	93.1	10.6
NOVEMBER	270	21	92.2	26.5	121	12	90.0	11.5
DECEMBER	293	36	87.7	21.0	167	14	91.6	12.5
TOTAL				271.1				196.5
AVERAGE	372	23	93.0		284	27	90.5	

NOTE:

- Approximately 44 composite samples were obtained at each sampling point during the year.
- PPM - Parts per million.
- Raw sewage containing an average of 1.85 tons of BOD per million gallons.
- Raw sewage containing an average of 1.42 tons of SS per million gallons.

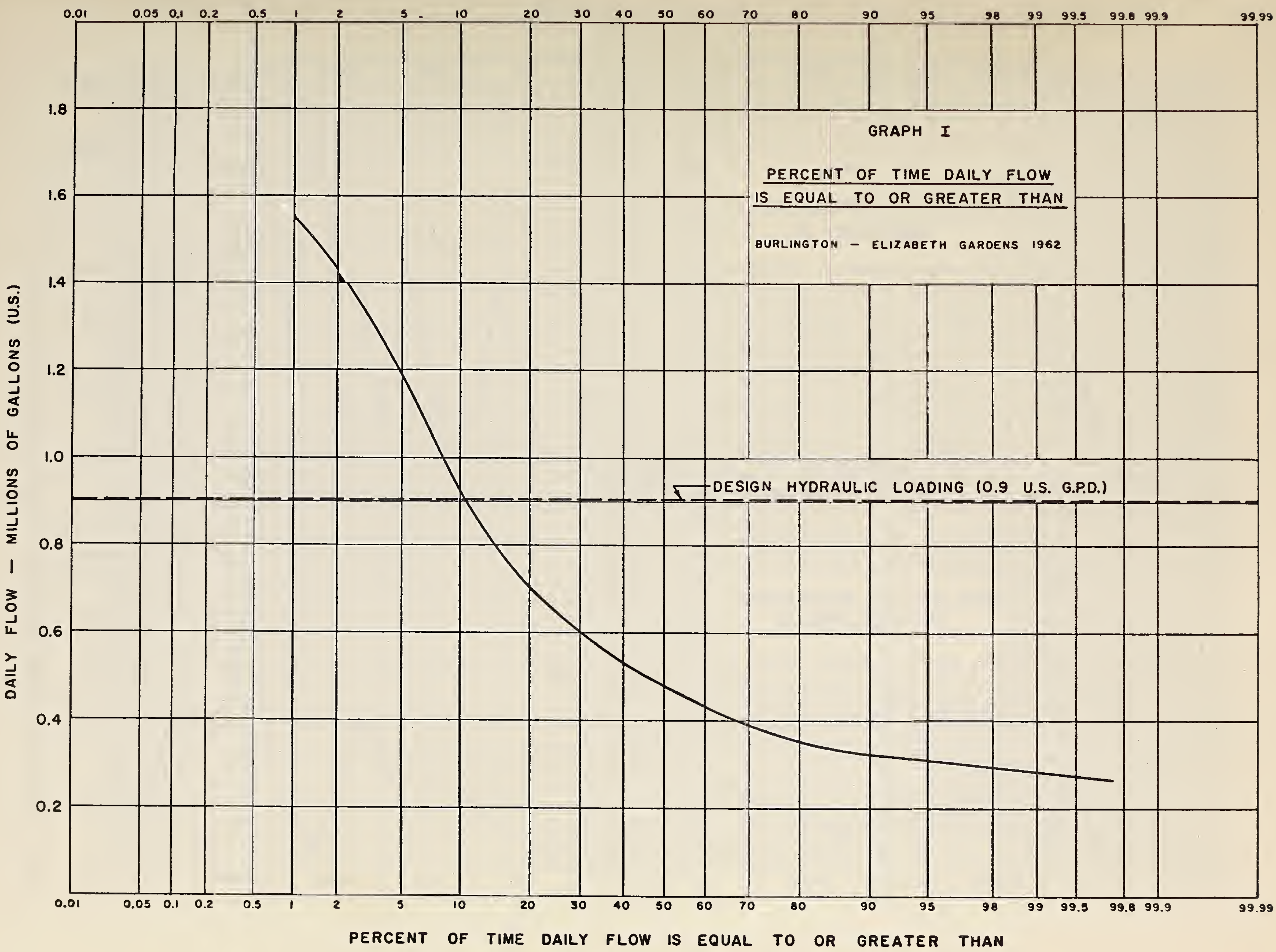
TABLE III

AERATION SECTION

MONTH	PRIMARY EFFLUENT BOD PPM	M.L.S.S. PPM	POUNDS BOD PER 100 LBS M.L.S.S.	TONS BOD REMOVED	CU.FT. AIR PER LB.BOD REMOVED	CU.FT.AIR PER GAL. OF SEWAGE	AERATION TANK EFFICIENCY
JANUARY	493	2395	26.7	24.7	1080	4.5	93
FEBRUARY	414	2454	21.6	17.6	1310	5.0	89
MARCH	234	2027	25.0	21.0	960	2.2	92
APRIL	300	1982	25.0	18.3	1280	3.6	95
MAY	173	1823	11.7	11.0	2130	4.3	95
JUNE	89	1222	8.3	3.3	4800	3.5	85
JULY	76	1017	6.0	1.8	9075	4.4	75
AUGUST	108	1354	13.0	3.8	4426	3.9	85
SEPTEMBER	159	1227	17.0	7.3	3105	3.5	90
OCTOBER	118	1377	21.0	9.4	1866	1.8	86
NOVEMBER	172	1628	27.0	15.6	1266	1.9	89
DECEMBER	212	2010	25.0	15.8	2060	3.2	82
TOTAL				149.6			
AVERAGE	171		19.0		2780	3.5	88

NOTE:
M.L.S.S. --Mixed liquor suspended solids.
Design loadings - FSIWA Manual of Practice No. 8
  Lbs BOD/100 lbs M.L.S.S. - 20 to 30
  Cu.Ft. of air/lb BOD removed - 600 to 1000
  Cu.Ft. of air/gal - 0.2 to 1.5*

* Sewerage and Sewage Treatment Eighth Edition.


GRAPH I

PERCENT OF TIME DAILY FLOW IS EQUAL TO OR GREATER THAN

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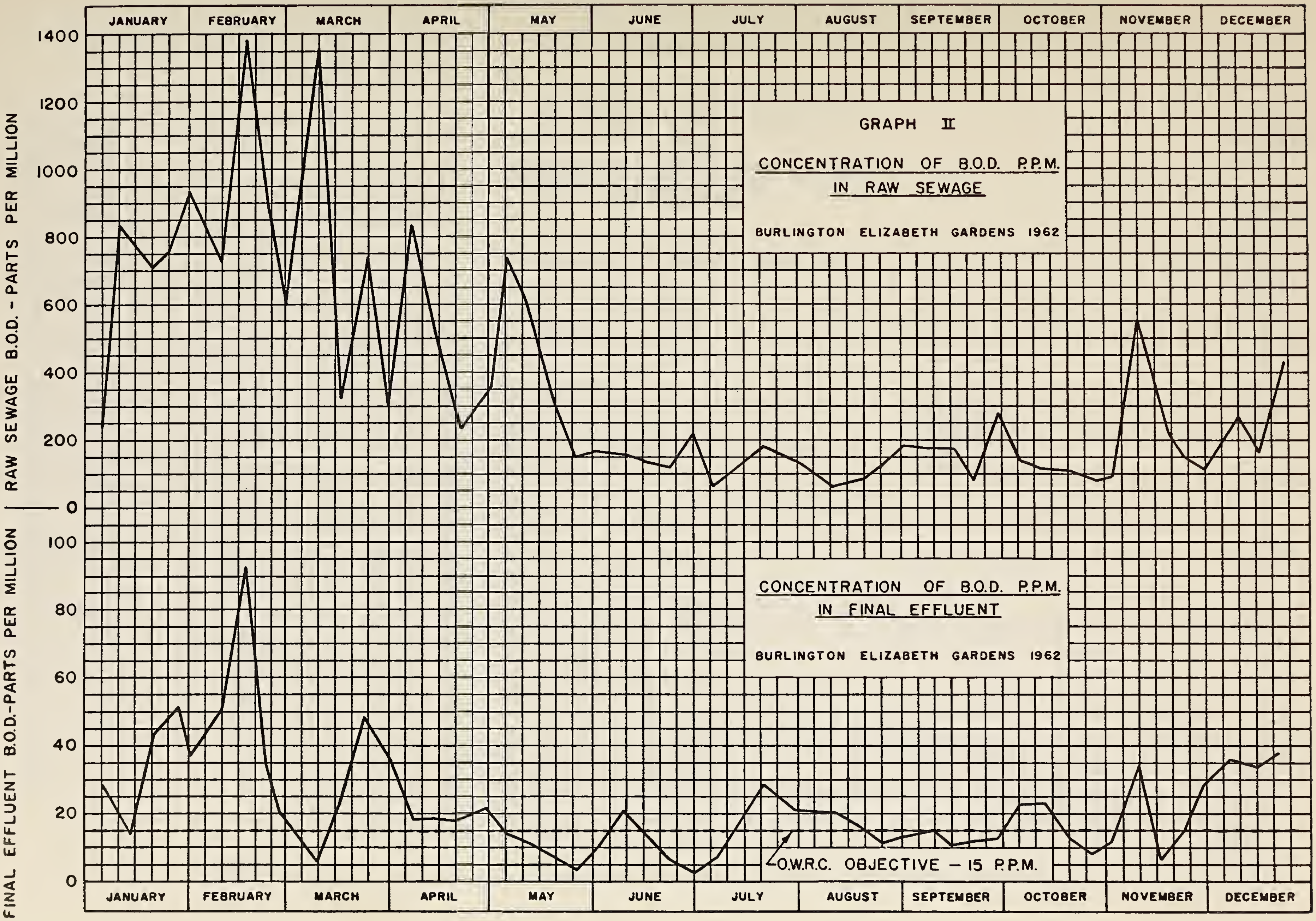

GRAPH II

CONCENTRATION OF B.O.D. P.P.M. IN RAW SEWAGE

BURLINGTON ELIZABETH GARDENS 1962

CONCENTRATION OF B.O.D. P.P.M. IN FINAL EFFLUENT

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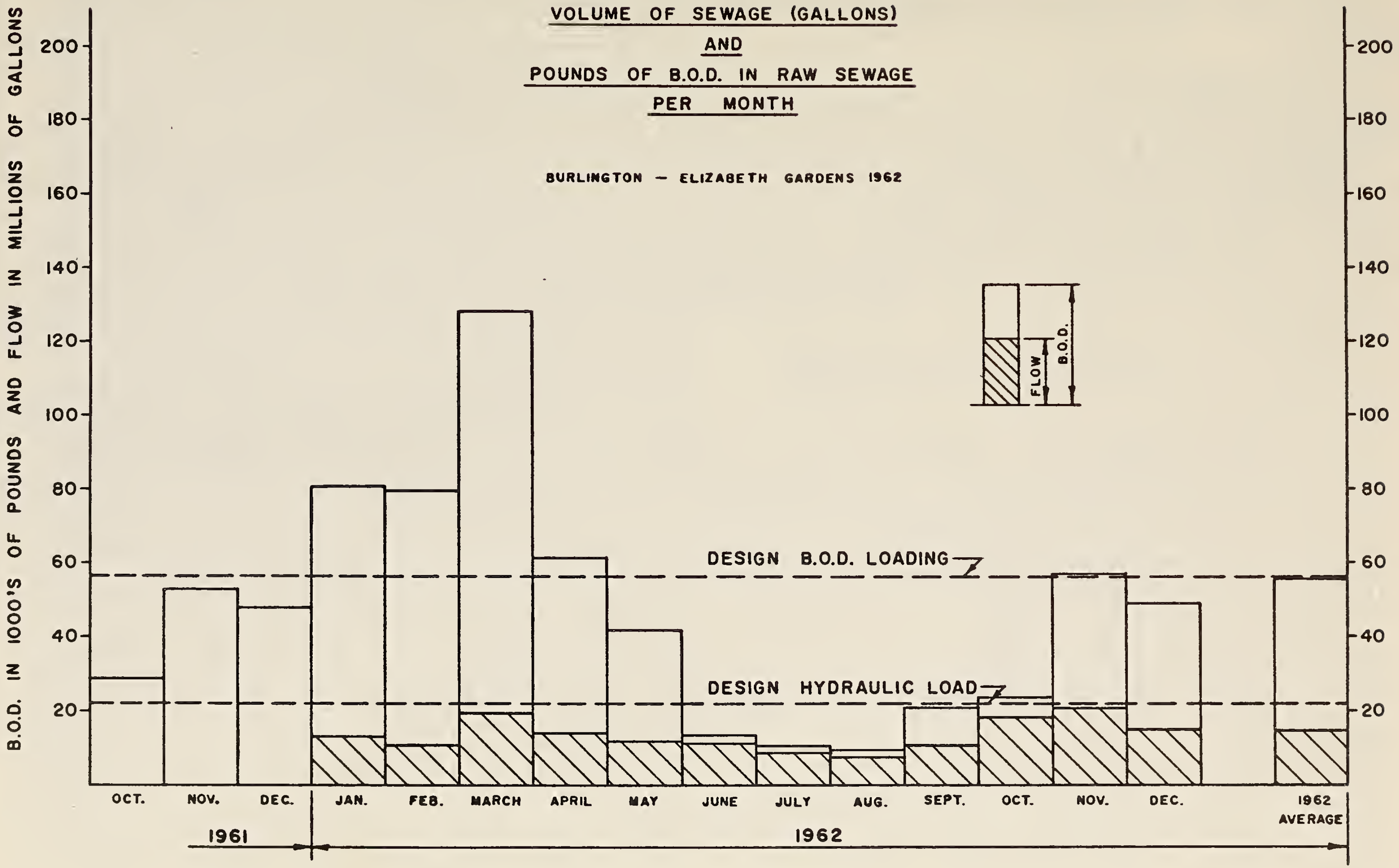
O.W.R.C. OBJECTIVE – 15 P.P.M.

GRAPH III

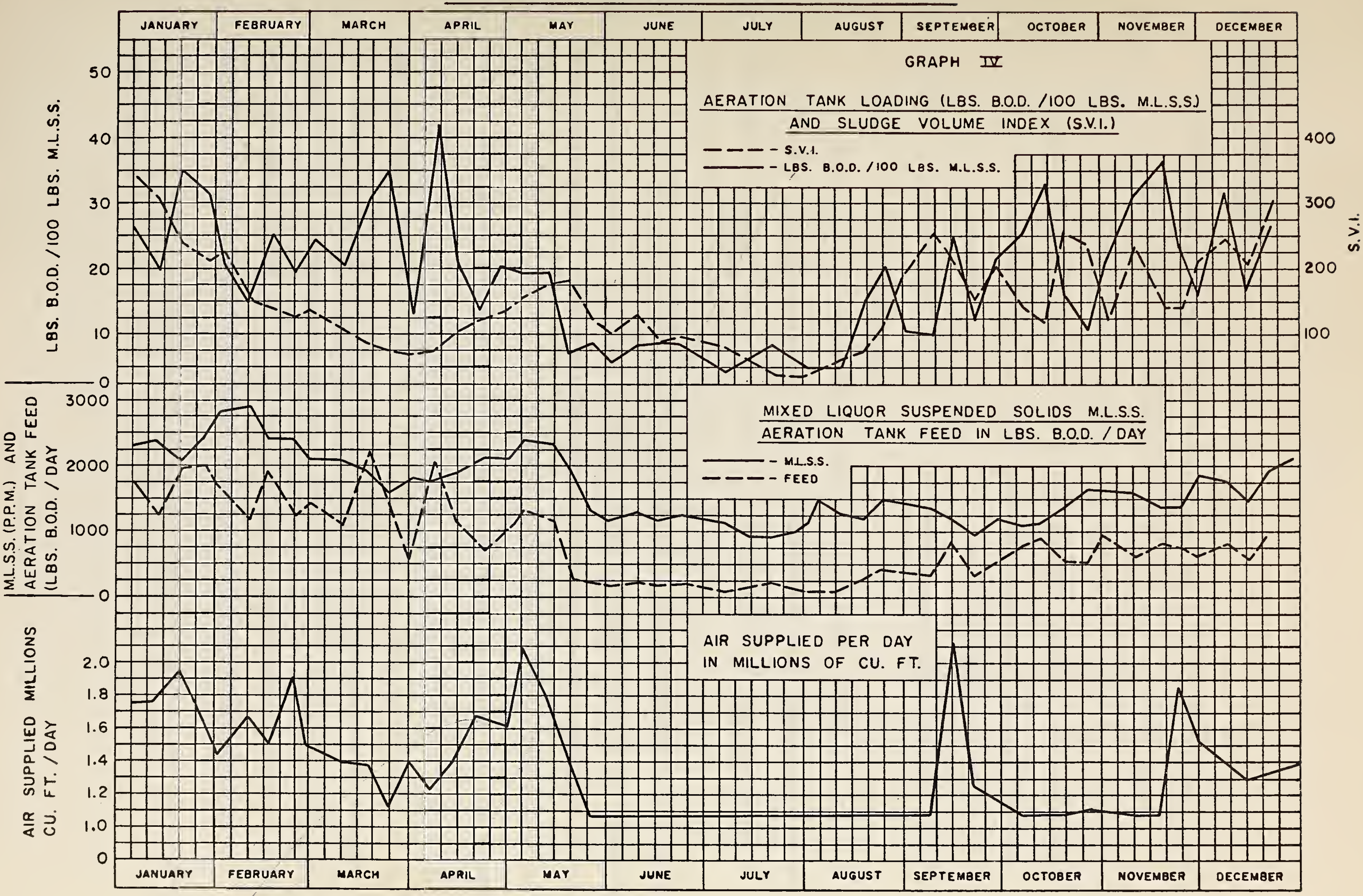


VOLUME OF SEWAGE (GALLONS)
AND
POUNDS OF B.O.D. IN RAW SEWAGE
PER MONTH

BURLINGTON — ELIZABETH GARDENS 1962

AERATION TANK RESULTS

BURLINGTON – ELIZABETH GARDENS W.R.C.R. – 1962



PLANT OPERATION

The plant was operated during the year by a Chief Operator, Mr. G. Stinson, and one operator, Mr. L. Horyk, under the supervision of the OWRC Division of Plant Operations. In general, the plant was staffed 8 hours per day from Monday to Friday with two hours of inspection on Saturday and Sunday. Casual labour was utilized during a portion of the summer months to fill in during vacations and help with the extra work load imposed on the operators during the summer months.

Piping changes were completed at the plant during the year to facilitate the bypassing of the aeration section during emergencies. This work was carried out by the plant staff and the mechanical section of the Plant Operations Division.

Many minor maintenance problems were encountered at the plant during the year. Problems were experienced with the heat exchanger, the spray pump, return sludge pumps, an air blower and one of the sewage pumps. Many of the repairs were made by the operating staff but it was also necessary for the mechanical section of the Plant Operations Division to spend 223 man hours of inspection and repair at the plant.

Very efficient operation was experienced during the summer with no odour problems reported. The reduced organic loading on the plant was due to the strike at the local meat packing plant. The problems associated with shock loading, however, reappeared during the latter portion of the year when the above plant resumed operation.

RECOMMENDATIONS

1. A suitable caulking material is required between the periphery of the steel digester roof and the digester wall. This would facilitate the operation of the digester over greater ranges of liquid level and thus provide more storage capacity.
2. Very high concentrations of BOD have overloaded the plant and caused odours as well as other operating problems. Every effort must be made to control the discharge of this material if the treatment plant is to operate satisfactorily during the summer months of 1963. It will be possible to direct much of this sewage to the new treatment plant in the future and it would, therefore, not be economically advisable to enlarge the Elizabeth Gardens plant to take this waste.
3. Storm water flows created operating problems during the year. Hydraulic surges disrupt the operation of the aeration section with the resulting poor quality of effluent following the surge. Again, the new treatment plant will aid in lessening the hydraulic shock loading on the Elizabeth Gardens plant as well as the shock organic loads.
4. The maintenance required at the plant has been increasing. This is, however, to be expected as the plant becomes older. Provision should be made for assistance to the operators for some of their major mechanical maintenance problems. It is therefore suggested that some integration of staff for all

4. Continued

three plants be employed so that assistance for maintenance problems, in particular, will be available for all plants.

OPERATING COSTS

ITEM	BUDGET	ACTUAL	DIFFERENCE
Payroll	11,000	$10,558.39	+ 441.61
Fuel	600	397.81	+ 202.19
Power	4,200	3,949.72	+ 250.28
Chemical	2,800	252.09	+ 2,547.91
General Supplies	1,500	1,230.53	+ 269.47
Equipment	400	950.29	- 550.29
Repair and Maintenance	700	335.41	+ 364.59
Sundry	3,700	3,748.38	- 48.38
Water	600	377.46	+ 222.54
	25,500	21,800.08	+ 3,699.92

PAYROLL

Estimate - $1,100 Actual - $10,558.39 Difference - $441.61

Casual labour was not required to the extent estimated in the budget.

FUEL

Estimate - $600 Actual - $397.81 Difference - $202.19

FUEL - Continued

The performance of the digester was better than estimated and digester gas was utilized for most of the heating at the plant.

POWER

Estimate - $4,200 Actual - $3,949.72 Difference - $250.28

Only eleven power bills were paid during 1962. If twelve bills had been paid, the estimate would have agreed more closely with the actual expenditure. The actual cost for power also included $184.36 for water.

CHEMICALS

Estimate - $2,800 Actual - $252.09 Difference - $2,547.91

A chlorine dosage of 17 pounds per day was required to maintain a residual. Therefore, the cost of chlorine consumed was 17 x 365 x $14/100 = $870. However, it is necessary to place a deposit on chlorine cylinders and this deposit is refunded when cylinders are returned. This effects the actual expenditures under chemicals drastically and is very difficult to estimate. However, this does average out over a period of time. During 1961, $2,486.46 was spent on chemicals but the actual expenditure during 1962 was considerably less.

GENERAL SUPPLIES

The actual expenditures were less than the estimate.

EQUIPMENT

Estimate - $400 Actual - $950.29 Difference - $550.29

Changes were made to the return sludge piping and the materials for this work cost $510. This was not included in the budget estimate for equipment and accounts for the difference between the actual and the estimate.

REPAIR & MAINTENANCE

Estimate - $700 Actual - $335.41 Difference - $364.59

The changes to the return sludge piping amounted to $510 but was recorded under equipment.

SUNDRY

Estimate - $3,700 Actual - $3,748.38 Difference - $48.38

The major item under sundry was sludge haulage which cost $2,547.40.

WATER

Estimate - $600 Actual - $377.46 Difference - $222.54

The actual cost of water for the above plant was higher by $184.36 than indicated above. Two of the expenditures for water were recorded in the power items. Therefore, the actual expenditure for water was $561.82 for the year.

The table below compares the unit costs for the treatment of sewage at the plant during 1961 and 1962:

YEAR	VOLUME SEWAGE TREATED M.G.	TOTAL OPERATING COST	COST PER 1000 GAL	COST PER LB. BOD REMOVED
1961	172.7	$ 22,091.39	12.7¢	4.1¢
1962	156.9	$ 21,800.08	13.9¢	5.5¢

The unit costs were higher during 1962 but the overall operating costs were less. The unit costs were lower.because less sewage and less BOD were treated during 1962. Since many of the operating costs are not dependent entirely upon organic and hydraulic loads (salaries, equipment, general supplies, insurance, etc.), then a decrease in strength and flow will not result in the same proportional saving in costs. Therefore, the decreased loading during 1962 did result in a slight overall cost saving but didn't lower unit operating costs.

ONTARIO WATER RESOURCES COMMISSION

BURLINGTON - ELIZABETH GARDENS
WATER POLLUTION CONTROL PLANT

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